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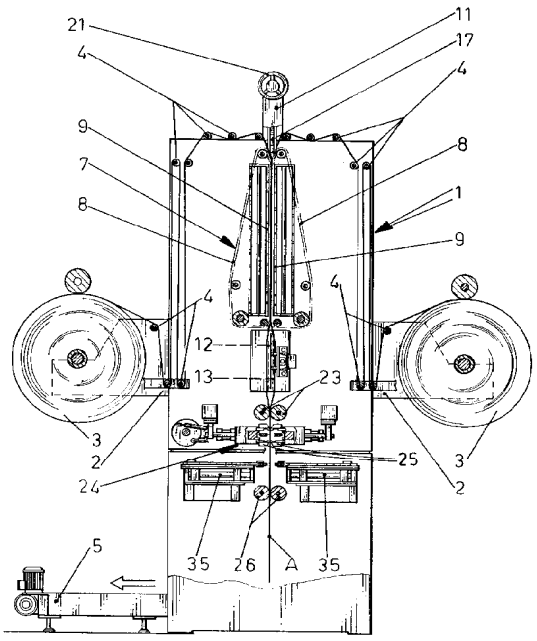
(54) Automatic machine for fashioning, filling and sealing gusseted plastic bags, in particular for packaging inert materials.

(57) The machine comprises a succession of work stations (S1, S2, S3, S4, S5) at which bags are formed from two rolls (3) of plastic film identical in width, filled, and closed ultimately by heat sealing ; the bag emerges already fully fashioned from the first work station (S1), having encountered dies (12) and folders (13) by which the sides are tucked in to form gussets, and transverse heat seal plates (25) positioned to unite only the gusseted parts of the top end on either side of the mouth, in such a way as to provide a reinforced opening for the filling operation.

FIG 1



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The invention relates to an automatic machine for fashioning, filling and sealing plastic bags with side gussets, in particular for packaging inert materials.

Conventional methods of packaging inert materials, for example powders, sand, cement, granules and the like, embrace the use of bags fashioned from a tube of plastic material (e.g. polyethene), or from two strips of plastic film of which the longitudinal edges are offered one to another on either side and heat sealed together.

The operations of forming, filling and closing the bags can be automated through the adoption of two basic techniques:

- a first, whereby the bags are part-formed with the bottom already heat sealed and then transferred in stacks to a magazine, thence to be taken up one by one and conveyed to a filling station;
- a second, applicable in cases where the bags are fashioned from two strips of plastic film uncoiled from two rolls and heat sealed together along the longitudinal edges, wherein the forming operation is effected continuously by means installed below a dispensing hopper charged with the material for packaging; such means are positioned beyond and in alignment with the hopper outlet, and designed to effect a first seal establishing the bottom of each bag prior to filling, and a second seal that closes and fastens the top or mouth of the filled bag.

This second bagging method has found favour with manufacturers to some extent, given the advantage that it dispenses with initial operations limited to part-forming and stacking a supply of bags, and thus avoids a further step of transferring the bags to a magazine for subsequent release one by one.

The technique in question is by no means free of drawbacks, however, given that the bags obtained are essentially cushion shaped, tapering to a point profile both along the longitudinal seams produced by sealing together the edges of the two strips of film and along the transverse seams produced by sealing the bottom and the mouth of the cut bag.

As a result of this negative factor, difficulties are experienced in stacking or palletizing the bags when filled, since the area of contact offered by one bag to the next is limited to the middle of the face, and will be of greater or lesser dimensions according to the quantity of material contained in the bags, and to its properties.

An attempt is made in Italian Patent n° 1 156 700 to overcome these difficulties encountered in the formation of bags utilizing strips of plastic film uncoiled from two separate rolls, by adopting a device designed to produce an 'S' or 'Z' fold along the longitudinal edges of one of the two strips in such a way as to form a gusset in each side of the single bag. The point profiles are thus eliminated, and the filled bag can be made to assume a shape approaching that of a parallelepiped.

This method betrays the drawback that the two rolls of strip material must necessarily be of dissimilar width; also, there is the need for special means by which to produce the 'S' or 'Z' folds in the wider strip, and means by which to hold the folds steady during the subsequent steps of forming and filling the bag.

In any event, the output of machines used in this particular manufacturing field will be dependent upon the time taken to fill and close the bags, two operations effected in sequence at the one station.

When one considers also that a pause, albeit brief, needs to be allowed for cooling purposes following the heat seals effected before and after filling, it will be readily appreciated that the cycle as a whole must be subject to a set of conditions and limitations imposed by the various steps: forming, sealing, cooling and finally ejection of the filled and finished bag.

The object of the present invention is to overcome the drawbacks mentioned above through the provision of an automatic machine equipped, as recited in the appended claims, with a plurality of work stations at which the bags are fashioned with fully formed side gussets, filled and then closed, respectively; a machine, moreover, by means of which bags can be manufactured from two strips of plastic film having identical dimensions.

To advantage, no pause effected by the machine in the course of the overall packaging cycle will be of duration greater than the longest discrete step within the cycle, for example the time taken to fill one bag; thus, one has no accumulation of dead time or pause components effectively governing the correct execution of the different operations which make up one cycle.

Likewise to advantage, the gusset folds are formed after the longitudinal edges of the two strips of film have been joined and sealed, and immediately prior to the steps whereby the bottom and the top ends of the bag are sealed. Accordingly, the means by which the bags are guided toward the filling station can be exploited additionally as guide means by which to hold the gusset folds correctly in position until sealed at the bottom and the top of the bag, and the need for further guide means is thus avoided.

A further advantage of the machine according to the invention consists in the fact that the mouth of the bag is created by sealing together the portions of the strip incorporating the gusset folds on each side, thereby avoiding the risk that the material on either side of the mouth will be torn during the filling operation by the grippers which hold the bag in position; instead, the bags are considerably strengthened in these same areas. Similarly, there is no need for the relative gusseted corners to be folded inwards prior to sealing the mouth of the bag, as is the case in conventional machines.

The invention will now be described in detail, by

way of example, with the aid of the accompanying drawings, in which:

- figs 1 and 2 are schematic drawings of the machine disclosed, dissimilar in scale, of which the first is a side elevation with parts shown in section and the second a front elevation;
- fig 3 illustrates various stages in the appearance of the bag at the different work stations of the machine;
- figs 4 and 5 provide schematic illustrations of conveyor means coinciding with C-C and D-D in fig 1 by which the bags are transferred from one work station of the machine to another;
- fig 6 is the front elevation, with parts cut away, of a device shown also in fig 1 by which bags are formed at the first work station of the machine;
- fig 7 provides a schematic illustration of the succession of different operations effected by the device of fig 6.

With reference first to figs 1 and 2, the machine according to the invention exhibits a frame 1 of which the top part, seen from the side, affords two brackets 2 carrying respective rolls 3 of plastic film material identical in width; the strips are unwound from the rolls 3, passed around a plurality of guide and tension rollers 4 and directed into a first work station of the machine, as described more fully in due course.

5 denotes a runout conveyor positioned beneath the final work station of the machine, by which the filled and finished bags are ultimately removed.

Viewed in the front elevation of figs 2 and 3, the machine exhibits substantially five work stations denoted S1, S2, S3, S4 and S5, arranged in series, at which the following respective operations are carried out:

- station S1, formation of a bag with side gussets already folded and bottom end sealed, and affording an open mouth at the top end flanked on either side by seals effected across the gusset folds;
- station S2, cooling of the heat seals effected at the preceding station S1;
- station S3, filling of the bag with material for packaging, appropriately metered and dispensed from a batching hopper 6;
- station S4, completion of the seal across the top of the bag to close the mouth, and cooling of the heat seal;
- station S5, removal of the filled bag from the internal conveyors of the machine, for transfer to a remote location.

The first station S1 of the machine essentially comprises a first heat seal device 7 consisting in two pairs of looped pinch belts 8 between which the two strips of film uncoiling from the rolls 3 are directed ultimately following their passage through the rollers 4. The two pairs of belts 8 are spaced apart one from another and positioned along the edges of the strips of film, adjacent to relative pairs of heat seal plates 9 of which the purpose is to join the stretch of the longitudinal edges of the two strips pinched between the belts, during the pause between the indexed steps of the machine, in such a way that the sirips are joined to form a tubular sheath.

10 denotes a support located between the pairs of belts 8, aligned with the median longitudinal axis of the strips (see fig 6), which remains interposed between the strips when joined along the edges by the heat seal plates 9. The support 10 is suspended from a cross beam 11 fastened to the top of the frame 1 and carries a pair of essentially U-shaped folding dies 12 disposed in alignment with the feed direction followed by the strips; the dies 12 are designed to operate in conjunction with a pair of folders 13 positioned to penetrate the U profile and thus fold the sealed edges of the plastic film in toward one another, forming a gusset on either side of the sheath.

The sheath is formed as shown in fig 7, where: sections a and b illustrate two possible methods of joining the longitudinal edges (the former with a folded seam, the latter plain) and section c shows the step of forming the gussets, effected by the dies 12 and folders 13.

Each die 12 is supported from above by a pair of parallelogram-linked rods 14 attached by one end to the die and by the other to the support 10, and at bottom by an arm 15 of which one end is pivotably anchored to the die 12 and the other to the head 16 of a threaded rod 17 carried slidably, though not rotatably, within the support 10. The top end of the threaded rod 17 engages in a threaded bush 18 mounted rotatably to and in captive association with the cross beam 11, the bush 18 in turn being connected with a bevel gear pair 19 and a shaft 20 in such a manner that it can be rotated in either direction to raise or lower the rod 17.

Thus, an upward or downward movement of the rod 17 has the effect of drawing the dies 12 farther apart or closer together radially, in relation to the tubular sheath, and therefore of altering the depth to which the sealed edges are folded back into the sheath.

The position of the folders 13 is adjusted to suit that of the dies 12 by turning handwheels 22 (see fig 6) coupled to corresponding threaded spindles (not illustrated) which are rotatable in threaded bushes carried by brackets fixed to the frame 1 of the machine and supporting the folders 13.

Emerging from the first heat seal device 7, the tubular sheath thus joined and folded is taken up between a first pair of pinch rollers 23, which compress and compact the gussets, and conveyed into a second heat seal device 24.

At the same time (given that the machine operates a continuous cycle), the portion of the sheath beyond the second heat seal device 24 emerges with: the filler mouth fashioned in a first bag A about to enter the second station S2; a seal effected across the bot-

tom of a second bag B, still in formation; and a transverse cut made across the width of the sheath, by which the mouth of the first bag A is separated from the bottom of the second bag B.

The second heat seal device 24 is not described in detail, being conventional in embodiment with heat seal plates disposed on either side of a blade by which the aforesaid transverse cut is effected.

This much said, the lower plates 25 of the second heat seal device 24 will be shortened, according to the invention, to engage only the outermost portion on either side of the emerging bag in such a way that when heat is applied, the mouth proper can be left open by uniting only those parts folded inward previously to form the two gussets. Thus, with the bottom of the bag A sealed and all of the relative folds united and secured, one has a finished gusset on each side, with the advantage that the mouth is strengthened to a notable degree and can be gripped safely and held open during a further step in which the bag A is filled.

The profile of the tubular sheath substantially at its passage through the first pinch rollers 23 is as in section d of fig 7, whilst that of the mouth of a bag A on emerging from the second heat seal device 24 is as in section e of fig 7.

Having cleared the second heat seal device 24, the bags are taken up between second pinch rollers 26 and then carried by conveyor means 27 (see fig 4), singly and in succession, through the successive work stations S2, S3, S4 and S5.

The conveyor means 27 occupy the plane denoted C-C in fig 2, and consist in pairs of chain loops 28, 29, 30, 31 and 32 each affording mutually opposed conveying branches disposed parallel with the path followed by the bags A. Each such chain loop is set in motion by a drive wheel 33 and trained around return wheels 34 mounted directly or indirectly to a frame carried by the bed of the machine.

More exactly, the wheels 33 and 34 of the chain loops denoted 28 (station S1), 30 (station S3) and 32 (station S5) are mounted to slides 35 (fig 1) that permit of drawing the relative pairs of chains together into a position whereby the bags between the conveying branches are carried forward, or of spreading the chains apart, accordingly, during the following steps:

- at station S1, as the bag emerges from the second heat seal device 24;
- at station S3, as the bag is filled;
- at station S5, as the filled bag is removed and transferred to the runout conveyor 5.

The drive wheels 33 might be connected mechanically in series by way of right angle drive couplings and cardan shafts, and set in rotation thus by a single motor not illustrated in the drawings.

Fig 5 illustrates further conveyor means extending from station S3 to S5 and operating in conjunction with the conveyor means 27 described above, which also afford support to the filled bags; the bags may be of considerable weight, in effect, and need to rest on a base when passing through the various work stations.

The conveyor and support means in question, which occupy the plane denoted D-D in fig 1, comprise a belt loop 45 tensioned around a pair of pulleys 36, one of which power driven by a chain looped around a coupling denoted 37. The coupling 37 is connected through a cardan shaft 38 to the live shaft 39 of one of the drive wheels 33 of the chain loops 29 operating at the work station denoted S2. The final station S5 is equipped further with a plurality of rollers 41 set in rotation by a chain take-off from the driving pulley 36 of the belt loop 45.

42 denotes one of a plurality of belts driven by a separate motor 43 and running transversely to the bed of the machine, alternated with the rollers 41 of the final station S5 and providing a conveyor by means of which to eject the filled bags from the machine; these belts 42 are disposed in alignment with and preceding the runout conveyor 5, and can be raised by means of a positioning device 44 to bring their bearing surfaces from a level below the crests of the rollers 41 to a level above.

Finally, it will be discernible from fig 5 that the conveyor means denoted 45 and 42 are carried by a frame 46 embodied independently of the machine bed, which can be adjusted for height by means of a geared motor 47 coupled mechanically to a threaded rod 48 inserted in a threaded bush associated with the frame. By rotating the rod 48 in one direction or the other, the frame 46 can be raised or lowered on a set of columns 49 and positioned stably at a given height in relation to the conveyor means 27 above.

Accordingly, it becomes possible to support bags of different longitudinal dimensions, and the machine is rendered flexible and adaptable to a variety of manufacturing requirements.

There now follows a brief description of the full operating cycle of the machine, terminating in the emergence of a filled and finished bag A.

Departing from the moment at which a cut bag A is distanced from the second heat seal device 24 by the second pair of pinch rollers 26, it is at this juncture that the first heat seal plates 9 draw apart, likewise the plates of the second heat seal device 24 and the second pair of pinch rollers 26, whereupon the chain conveyor means 27, the conveyor and support means 45 and the ejection and runout conveyor means 41, 42 and 5 are all set in motion.

In the interests of simplicity, it should be made clear that the indexed movements of all conveyor means in the machine are geared to the length of the pause required to fill one bag, and that the three pairs of chain loops denoted 28, 30 and 32 are drawn together and spread apart in time with these indexed movements and pauses.

The first chain loops 28 are drawn together, thus

initiating the transfer of the bag from station S1 to station S2.

With the bag positioned at station S2, the conveyor means 27, 41, 42 and 5 cease movement, the first chain loops 28 are spread apart, and the first and second pairs of pinch rollers 23 and 26 are drawn together in such a way as to advance the tubular sheath; broadly speaking, activation of the various devices of the first station S1 is synchronized in such a way that a new bag A emerges from the second heat seal device 24 with each step indexed.

Accordingly, a further cycle now commences in the manner already described, and the bag A occupying station S2 moves toward station S3 to be taken up between the corresponding chain loops 30, leaving station S2 vacant for the bag following.

At station S3, the chain loops 30 draw apart and the bag A is taken up by gripper means and sucker means (not shown in the drawings) by which it is held steady beneath the hopper 6 with the mouth open. The parts of the mouth secured by the gripper means, it will be recalled, are the end portions fused previously by the second heat seal device 24 operating at station S1.

As the material discharges from the hopper 6 into the bag A, a motorized vibrator 40 is activated in such a way as to agitate the belt 45 supporting the bottom of the bag; the contents of the bag are thus compacted and the filling operations optimized.

With the bag A filled, the two chain loops 30 draw together, the gripper and sucker means deactivate, and the bag A is transferred, still supported by the belt 45, from station S3 to station S4.

With the bag A now held between the relative chain loops 31, a third heat seal device (conventional, therefore not illustrated) operates at this same station S4 to close up the filler mouth.

The machine indexes another step, and the filled and sealed bag A is transferred from station S4 to station S5 by the combined action of the relative chain loops 31 and 32.

With the bag A now occupying the final station S5, the chain loops 32 are distanced one from the other and the transverse belts 42 elevate into the raised position, thereby entering into contact with the bottom of the bag; finally, the bag drops flat (see fig 3) and is carried onto the runout conveyor 5.

It will be seen from the foregoing that the stated object is fully realized in a machine according to the invention.

In effect, with each step of the cycle indexed by the machine, one filled and finished bag emerges while another step of the same cycle is implemented on other bags, and there is no accumulation of dead time such as would occur if the duration of single operating steps were to be determined subjectively.

The expedient of "preforming" the mouth of the bag and sealing the bottom with the gussets already folded ensures not only that the finished bag will be substantially parallelepiped in shape, but also that the mouth can be held securely during the filling operation without risk of being torn.

Claims

1) An automatic machine for fashioning, filling and sealing plastic bags embodied with side gussets, in particular for packaging inert materials, of the type in which single bags are formed from a tubular sheath consisting in two strips of plastic film material uncoiled from two relative rolls, offered one to the other and sealed together along the corresponding longitudinal edges,

characterized

in that it consists substantially in a succession of work stations (S1, S2, S3, S4, S5) connected one with the next at least through conveyor means (27) by which the bags in process are transferred step by step from the first station (S1) to the last station (S5), the first station (S1) comprising:

- means by which to support two rolls (3) of strip film material identical in width;
- a first heat seal device (7) by which the edges of the two strips of film uncoiled from the rolls are united longitudinally to form the tubular sheath;
- a second heat seal device (24) positioned following the first (7) in the uncoiling direction and serving to effect two transverse seals across the strips, one to form the mouth of a bag (A) with the bottom already sealed, the other to form the bottom of a successive bag (B), of which the heat seal plates (25) which form the mouth engage only the outermost portions of the two strips of film united previously along the longitudinal edges;
- folding means (12, 13) positioned between the first heat seal device (7) and the second heat seal device (24), by which the sides of the emerging bag are folded back into the tubular sheath obtained by uniting the longitudinal edges of the two strips of film, in such a way as to form relative gussets;
- cutting means associated with the second heat seal device (24), which serve to separate successive bags (A, B) one from the other following completion of the respective mouth and bottom seals by the device (24); and,

in that the side gussets of each bag are rendered stable by the seals effected by the second heat seal device (24) across the mouth of the one bag and the bottom of the successive bag.

2) An automatic machine as in claim 1, wherein folding means comprise:

- a pair of substantially U-profile dies (12) disposed in alignment with the direction followed by the tubular sheath and radially adjustable for

position in relation thereto, which are carried by a support (10) suspended from the frame of the machine in a position coaxial to the sheath;

– folder elements (13), supported in such a manner that their position can be adjusted in relation to and according to the position of the dies (12), by which the two edge portions of the sheath destined ultimately to form the sides of the bag are folded into the corresponding U-profiles.

3) An automatic machine as in claim 1, comprising at least one pair of pinch rollers located between the folding means (12, 13) and the second heat seal device (24), by which the sheath is advanced with the gussets folded and held in place immediately preceding the second heat seal device (24).

4) An automatic machine as in claim 1, wherein:

– the second work station (S2) is equipped with conveyor elements (29) by which successive bags are taken up from the first work station (S1), retained for a duration sufficient for the heat seals effected at the first station to cool to ambient temperature, and transferred to further conveyor elements (30) of the following station (S3);

– the third work station (S3) comprises gripper means and sucker means by which to secure and open the mouth of a bag occupying the station (S3), operating in concert with movements and pauses of the conveyor elements (30) in such a way as to open the mouth beneath a hopper (6) from which a batched measure of the material for packaging is discharged into the bag;

– the fourth work station (S4) is equipped with conveyor elements (31) by which filled bags are taken up from the conveyor elements (30) of the third station (S3) and positioned at a third heat seal device by which the mouth of the bag is closed during a pause of the conveyor elements;

– the final work station (S5) is equipped with conveyor elements (32) by which fully sealed bags are taken up from the preceding station (S4), and with conveyor means (42) operating in a direction transverse to the direction followed by the bags in passing from the first station (S1) to the final station (S5), by which each successive filled and sealed bag is engaged from beneath, caused to drop into a horizontal position and ejected horizontally onto a runout conveyor (5).

5) An automatic machine as in claims 1 and 4, further comprising conveyors (45, 41) extending from the third work station (S3) to the final station (S5), operating in conjunction with and in the same direction as the conveyor means (27), by which bags filled at the third station (S3) and transferred between or occupying the successive stations (S4, S5) are supported from beneath.

6) An automatic machine as in claims 1 and 4, wherein conveyor means (27) are provided by the individual conveyor elements (28, 29, 30, 31, 32) of the single work stations (S1, S2, S3, S4, S5).

7) An automatic machine as in claim 5, wherein the conveyors (45, 41) extending from the third work station (S3) to the final work station (S5) are carried by a frame (46) that is adjustable for height.

8) An automatic machine as in claim 5, further comprising a motorized vibrator unit (40) operating at the third work station (S3) and acting on the conveyor (45) by which the bags are supported from beneath during the filling operation.

FIG 1

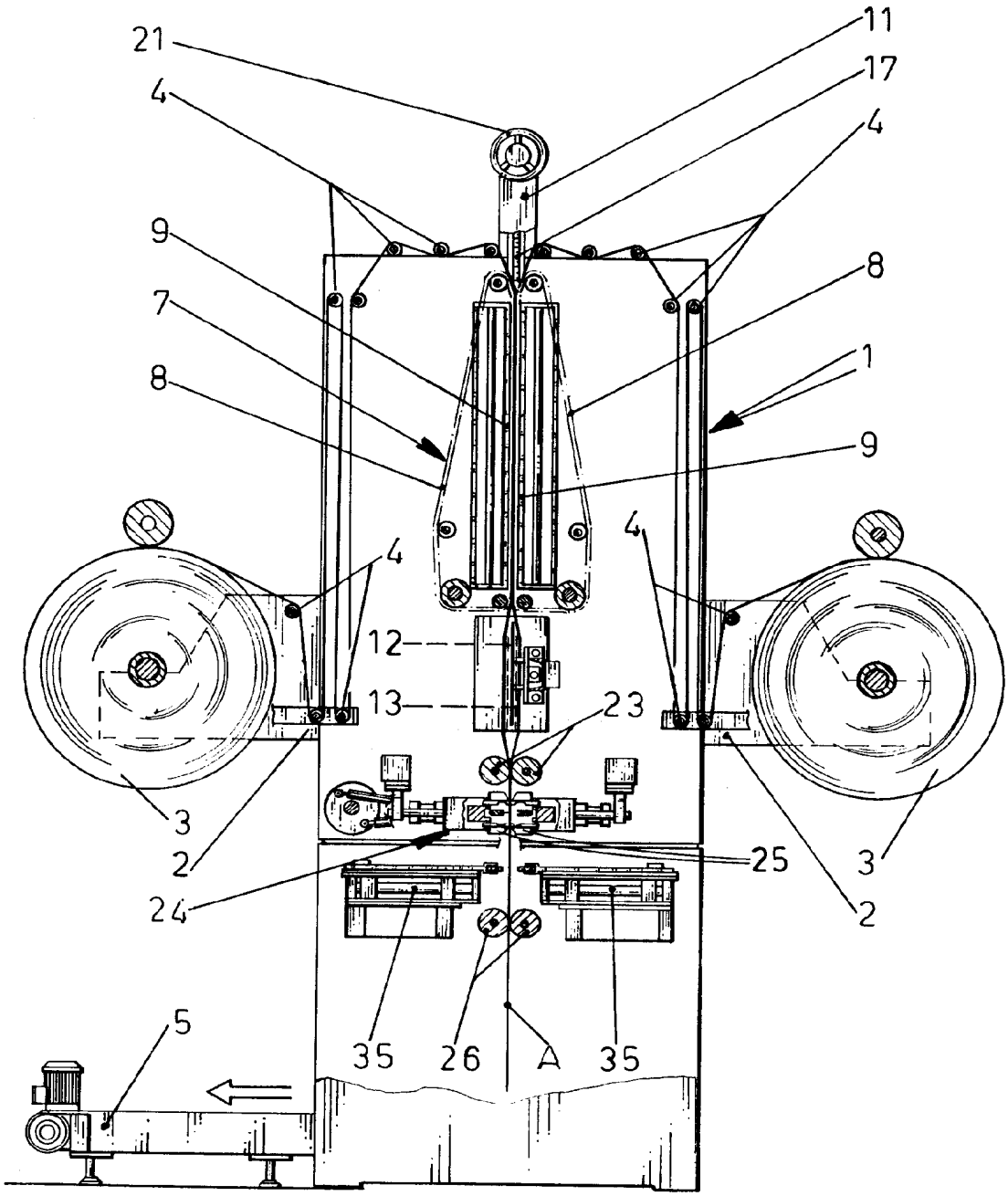


FIG 2

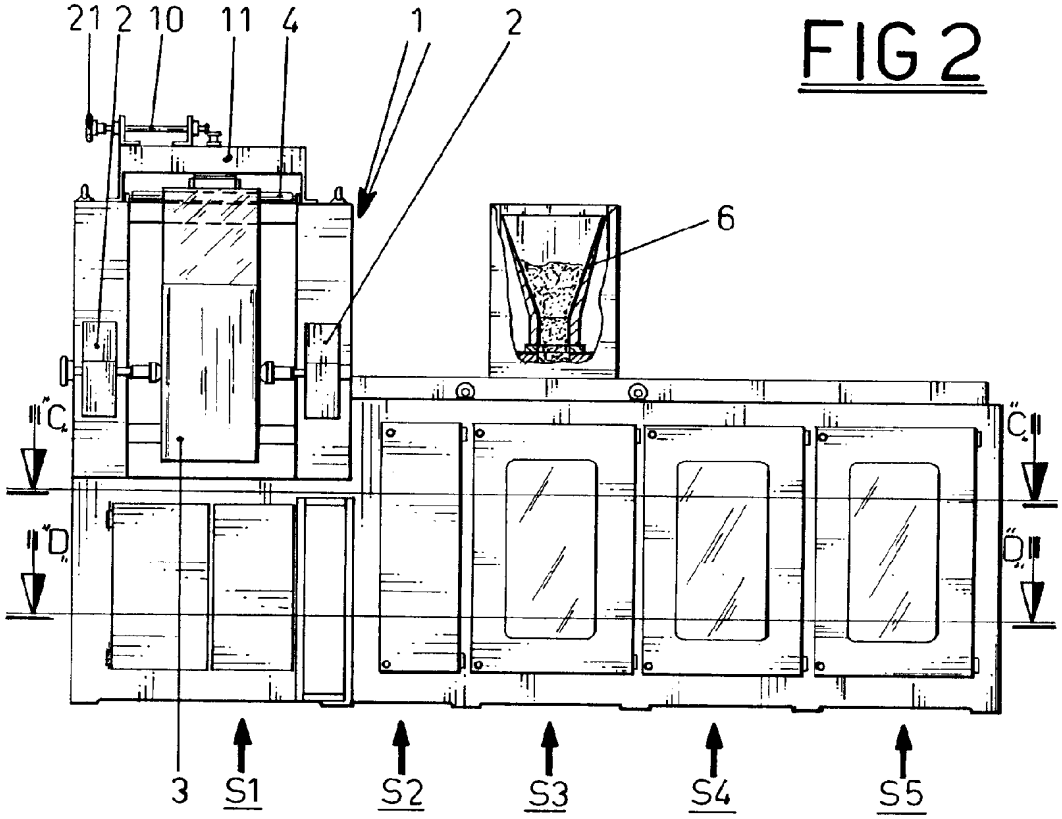


FIG 3

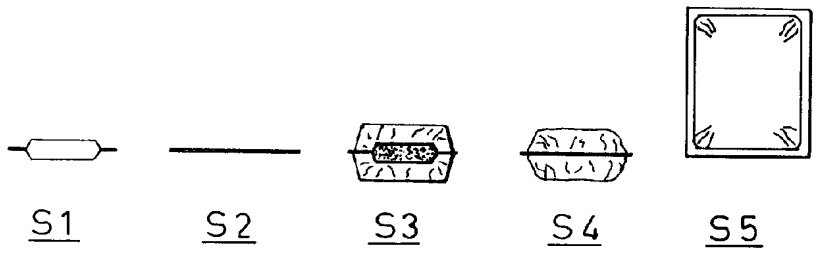
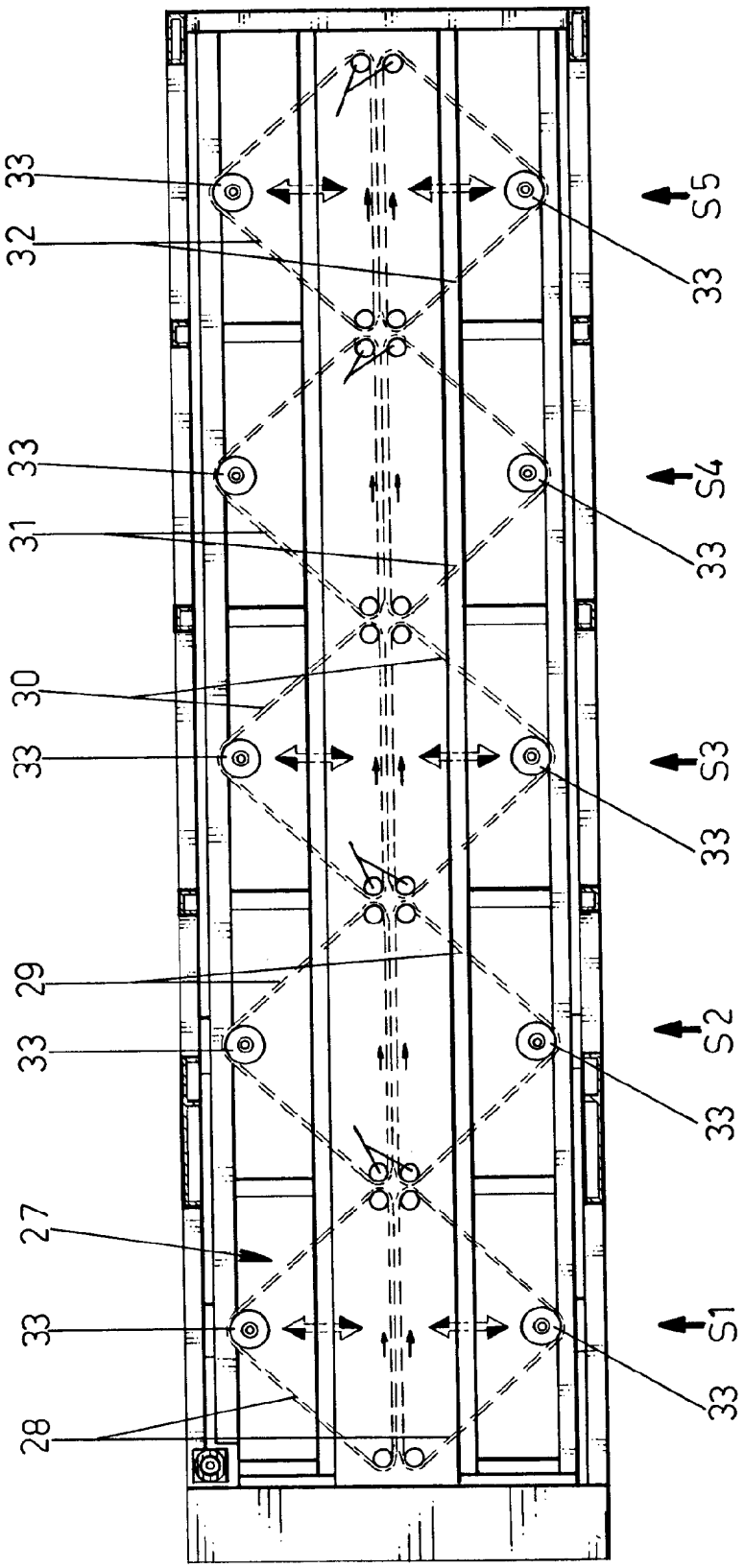


FIG 4



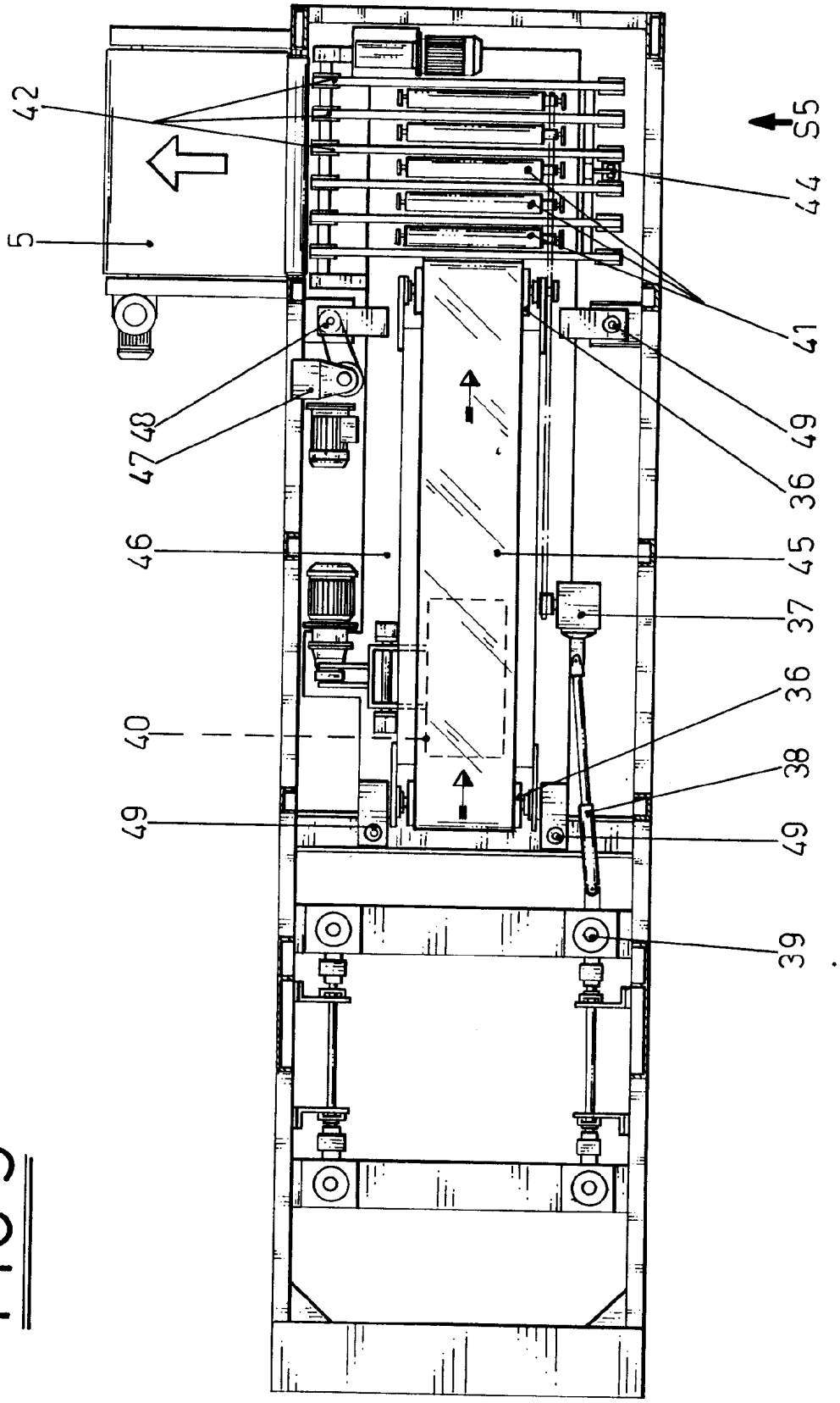


FIG 5

FIG7

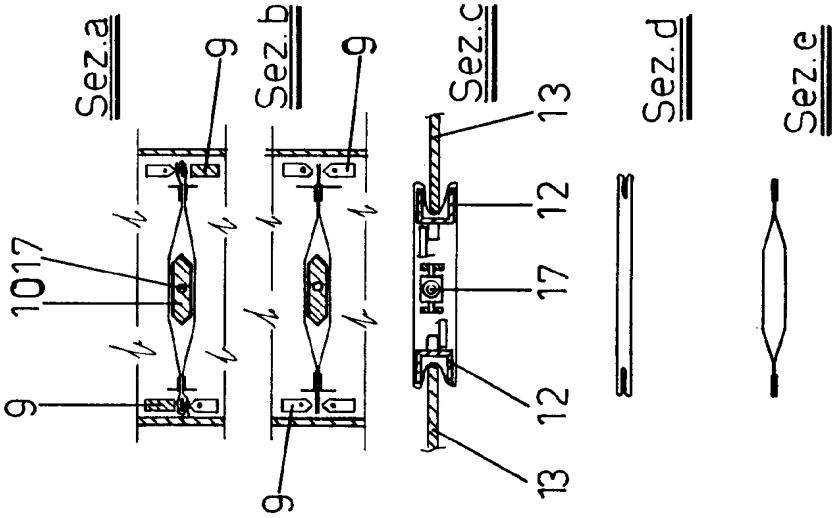

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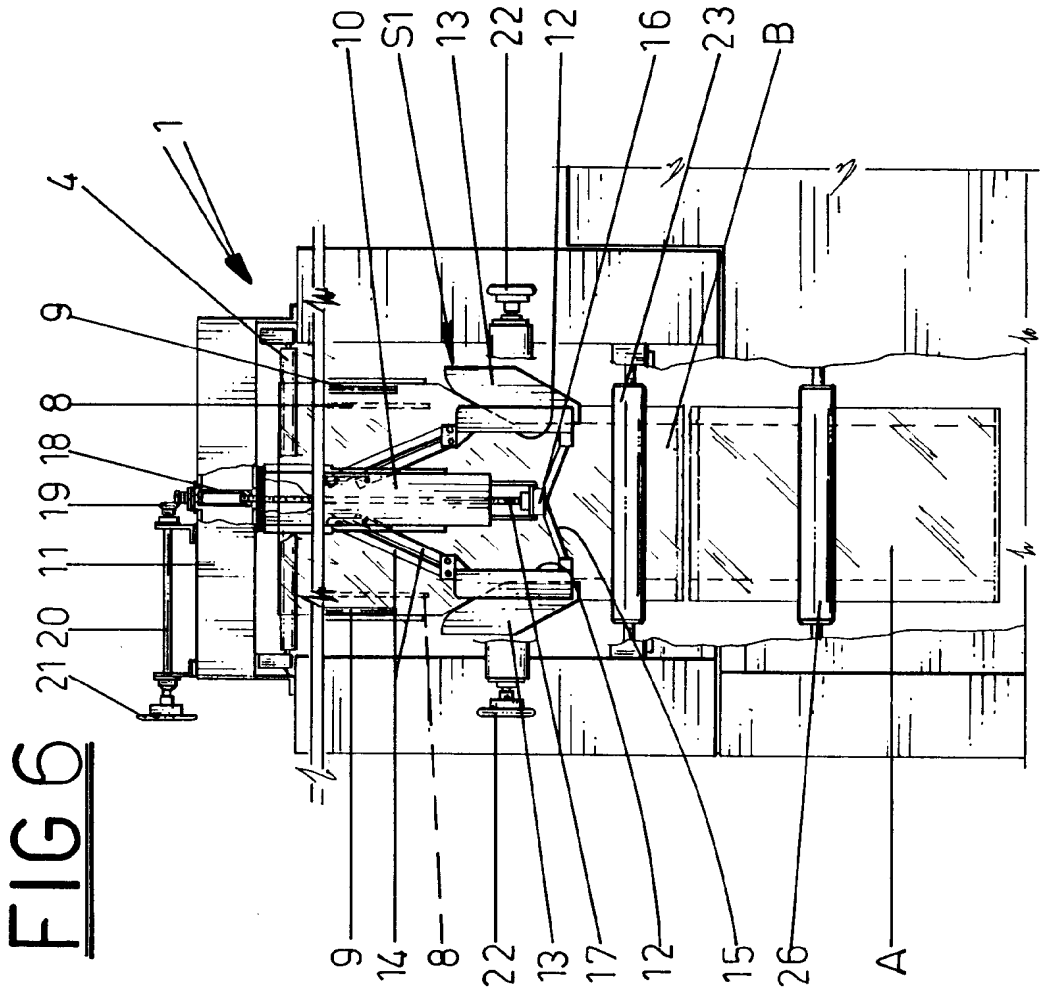
FIG6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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0546

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 397 099 (VETTORATO) * abstract; figures 1,4-6,8 * * column 1, line 4 - line 32 * * column 4, line 11 - column 5, line 22 *	1,2	B65B1/02 B31B23/00
A	FR-A-2 309 404 (HAVER & BOECKER) * the whole document *	1	
A	US-A-3 372 625 (SIMECEK) * column 2, line 69 - column 3, line 5; figure 1 *	3	
A	US-A-2 676 442 (GAUBERT) * column 4, line 6 - line 13; figure 29 *	4	
A	GB-A-944 776 (HESSER) * page 4, line 13 - line 31; figures 1,5 *	2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5) B65B B31B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 MARCH 1992	CLAEYS H.C.M.

CATEGORY OF CITED DOCUMENTS

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